

Master internship offer: Metamodelling under inequality constraints

Chair in Applied Mathematics OQUAIDO

Context and methodology

This master internship offer is associated to the Chair in Applied Mathematics OQUAIDO of Mines Saint-Étienne, which started in January 2016. The Chair, which follows the ReDICE consortium (www.redice-project.org), aims at gathering industrial and academic partners around innovative mathematical methods for the design and analysis of computer experiments. Among the research lines with strong methodological interest and promising application potential that have been identified by the Chair scientific committee, this internship position will focus on models with inequality constraints, such as boundary or monotonicity constraints.

Among existing research on the topic, a promising Gaussian process-based model has been proposed by (Maatouk, Bay, 2014), which satisfies inequality constraints (boundary, inequality, convexity) everywhere in the space, contrarily to other approaches based on spatial discretization. However, the model has two limitations: Its application is limited to a small number of constraints (1, 2 or 3) because of the tensorization technique used, and parameter estimation is based on a time-consuming cross-validation.

The aim of the internship is to explore ways of improvement, based on an initial literature review. This work should propose practical realistic solutions for a future development in a three year PhD thesis. If a full investigation is not required, preliminary tests on toy functions are expected.

Applicant profile

Candidates should follow Master 2 studies (or equivalent, e.g. final year in engineering schools) in applied mathematics, statistics, machine learning, or related disciplines. The applicant should demonstrate both theoretical and computational skills. Implementations in R are expected.

CV and motivation letter in English or French should be sent to the coordinators of the Chair (Olivier Roustant and Nicolas Durrande) using the e-mail address: oquaido@emse.fr.

PhD thesis

The aim is to pursue this work by a PhD thesis. Half of the funding is already provided by the Chair, and the second half is pending.

Conditions

- Date/duration: The position is a 4-6 months contract, from April-September 2016.
- Location: Mines Saint-Étienne, France.
- Internship allowance: 500 €/month

References

- S. Da Veiga and A. Marrel (2012), “Gaussian process modeling with inequality constraints”, *Annales de la Faculté des Sciences de Toulouse*, **21**, p. 529–555.
- S. Golchi, D. R. Bingham, H. Chipman, and D. A. Campbell (2015), “Monotone Emulation of Computer Experiments”, *SIAM/ASA Journal on Uncertainty Quantification*, **3** (1), p. 370-392
- H. Maatouk and X. Bay (2014), “Gaussian Process emulators for computer experiments with inequality constraints”